

120BAR OIL SYSTEM MANAGEMENT

<i>Rev.</i>	<i>Date</i>	<i>Modification</i>
1	24/09/24	Updated 3D and P&ID for ECOS+ and ECOMIDDLE
0	06/05/22	

This document is deemed as *Classified*. This means that first circulation is limited to selected people, who must diffuse it only as strictly necessary for correct operations.

Sommario

1. Oil system	3
2. Sampling, oil replacement and addition	5
3. Schematics and P&I for EcoLarge - EcoGiant	8
4. Schematics and P&I for EcoSmall+	9
5. Schematics and P&I for EcoMiddle	10

1. Oil system

The new oil system consists of (see figure 2.22):

- Oil separator with integrated reserve (1): located in the discharge MT compressors line, it is divided in two parts: in the upper part a filter separates the oil from the CO₂, on the bottom part the oil is recovered in an integrated oil reserve, inside the separator. The separator and the integrated reserve work at the same pressure of the gas cooler.
- Oil Reserve (2): additional oil volume installed in parallel with the separator. A safety valve (120bar) and oil injection optical sensors are mounted on the reserve. The reserve works following the gas cooler pressure.
- Oil Injection electronic regulators: installed on each compressor to regulate oil injection.

The whole oil system has security pressure of 120bar and follow the gas cooler pressure. Stainless steel AISI 304L is used for piping.

In fig. 2.22 are shown the main components of the oil circuit. On the back you can see the Schultze separator (1). In front there is the oil reserve (2), connected to the oil separator with top and bottom pipes. In the lower half of the reserve there is the oil level sensor (3) with the only purpose to highlight a low level of oil in the system. On the bottom part of system, there is the filter (4) and the pipe to feed the compressors. In the upper part there is the previously mentioned safety valve (6). Ball valves are always provided (10,11) to allow the exclusion of the oil reserve and allow an additional charge of oil in case of need.

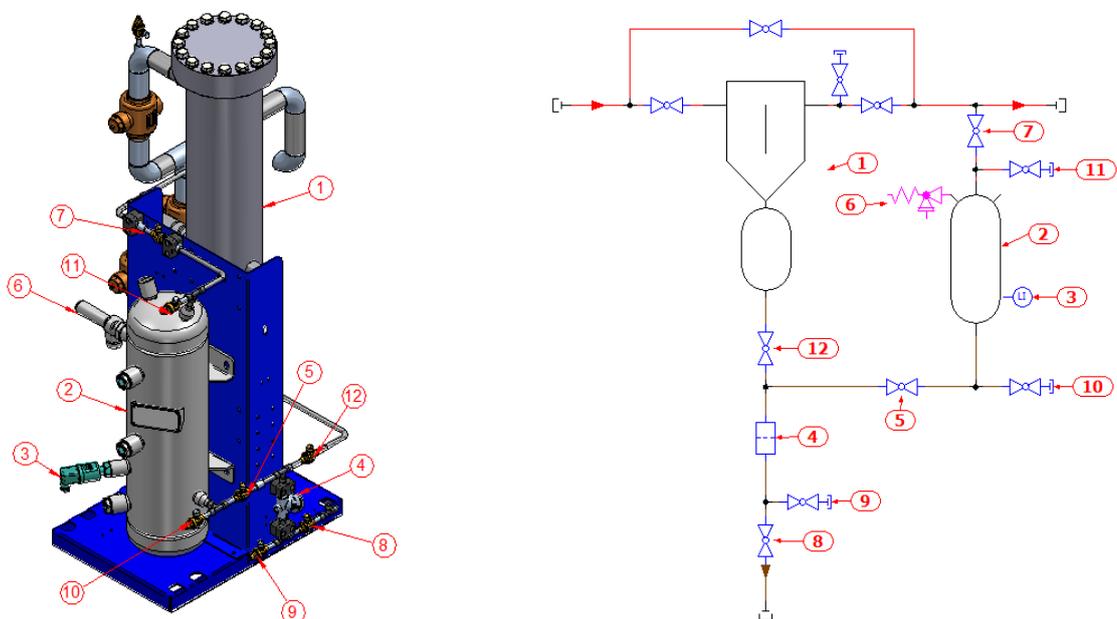
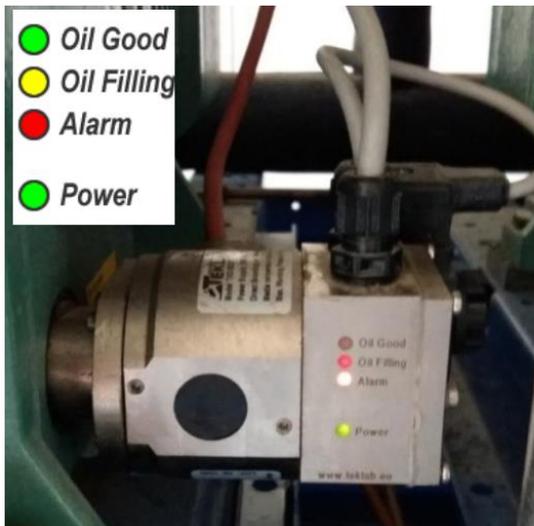


Figure - 2.22

120bar oil system management

The oil system works as follow:

- The separator recovers the oil present in the refrigerant and through the connection between the separator and the reserve, the oil level is distributed equally between the two volumes.
- Oil ejection electronic regulators are dedicated to control and inject the oil to assure a proper running of the compressors. The regulator checks the oil level through the electro-optical sensor and use a solenoid valve to allow oil filling. The solenoid valve is closed when there is enough oil in the compressor and opens if the level inside the regulator is too low. A relay output generates an alarm or stop the compressor in case oil is missing. The alarm status is indicated by the red LED. The LEDs of the electronic sensor immediately provide information about the status of the system. **It is possible to replace the electrical part of the Teklab without stopping the pack because it is separated from the mechanical part under pressure!**



Oil Good (green): lit up if the oil level is enough, flashing if oil level is not enough before starting the filling (even in case of waves or turbulence of oil in the teklab) and switched off in filling mode.

Oil filling (yellow): switched off if the oil level is enough, lit up in filling mode, flashing in checking mode.

Alarm (red): switched off if the oil level is enough, lit up when, after certain filling tentatives, the oil level is not enough. The alarm reset is automatic when the oil level is restored.

Power (green): always lit up when the Teklab is powered.

Figure 2.24 – Oil regulator Teklab

- After 10 seconds of low oil level (green LED flashing) the filling phase starts. The oil injection sequence is as follows: 5 sec, 8 sec, 10 sec, 12 sec, 15 sec, 20 sec, 25 sec. The oil injection goes on from 5 sec (for the first cycle) to 25 sec (for the last cycle before the alarm). After 45 seconds, in which the teklab checks the oil level inside, a further filling can start, or return to the normal operating conditions. Before generating the alarm, in case of failure on refilling the oil, 7 filling cycles are carried out (equal to 7 minutes).

Figure 4.9 – Oil level indicator in the separator / reserve

SEPARATOR INDICATOR



RISERVE INDICATOR



2. Sampling, oil replacement and addition

Sampling of oil

It is necessary to take an oil sample with the dedicated container provided by EPTA (fig. 3.7) so that a certified body (Mecoil) can perform the analysis. (Refers to figure 3.6)

Identify the sampling point, preferably from the service valve on the bottom part of the oil reserve (10).

- Close ball valves 7 and 5 and to vent from service valve 11.
- After having taken the oil, put the oil reserve under pressure by opening the ball valves 5 e 7.
- Report on the label (fig. 3.7) all the information required, to have the most truthful analysis possible
- Clean the sampling point.
- Vent a little oil to clean the flexible pipe of any residues.
- Fill the container to at least half its capacity.
- Close the lid of the bottle immediately to avoid possible contamination.
- Remember to send the sample with the completed form.



Figure 3.7 – Oil bottle, label to be applied on the bottle and form to be filled in and delivered.

120bar oil system management

Oil filling procedure before starting

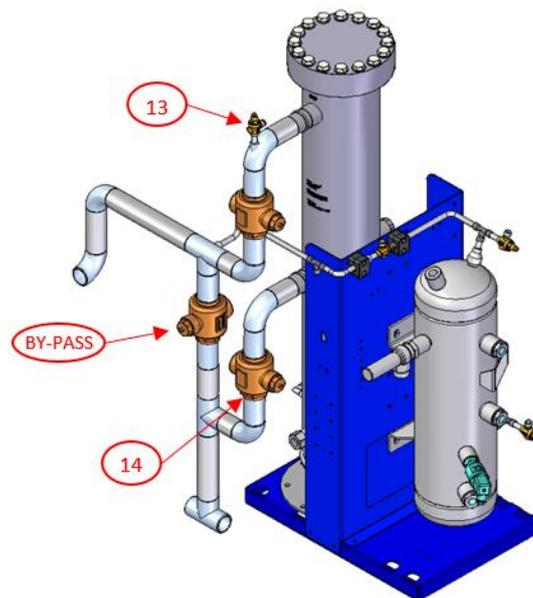
The following are the procedures that must be done to charge oil into the system BEFORE STARTING the system. Check the position of the ball valves from figure 3.6.

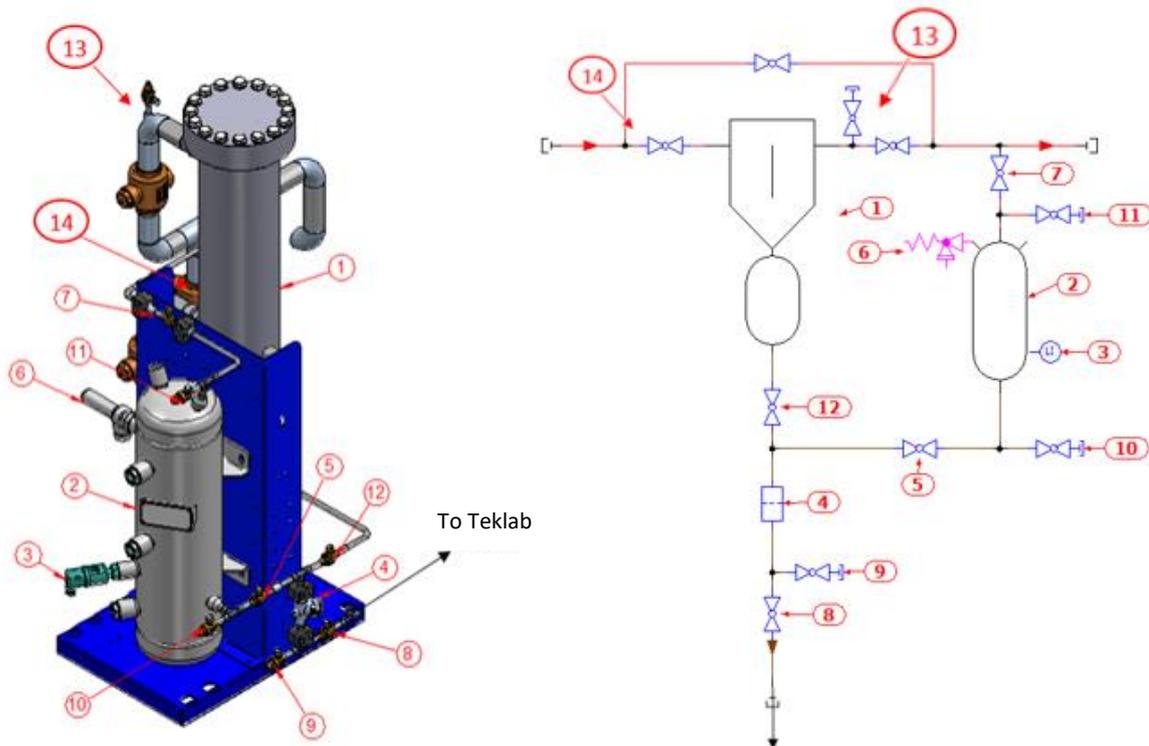
- Vacuum the system
- Close ball valve n° 8 (downstream of the ball valve there is the oil collector for the distribution to the teklab of the compressors) and close the ball valve 14 (the one before the separator)
- Open ball valves 5 and 12, close the ball valve 7.
- Connect the vacuum pump to the service valves 11 and 13.
- The oil can be charged with an electric pump or hand pump as follows.
- Charge the oil from service valve 10. Charge **oil Bitzer BSE 85K**.
- Continue the charge, giving the time to the oil to pass from the reserve 2 to the separator 1 through ball valves 5 and 12.
- In total, before starting the system, the following quantities must be charged in the reserves:

	LITERS OF OIL TO CHARGE
<i>EcoSmall+</i>	About 10 LT
<i>EcoMiddle</i>	From 10Lt to 18LT about ^(*)
<i>EcoLarge</i>	From 18 LT to 25LT about ^(*)

^(*) depending by oil separator model

- When the charge is complete, the oil fills the optical indicator in the separator 1 on the bottom part. **GENERAL RULE: DO NOT EXCEED THE THIRD OIL LEVEL INDICATOR OF THE OIL RESERVE**
- Close ball valve 11, close ball valve 13 and open ball valve 7 and 14.
- Make sure to open 8 before the commissioning of the system.





Oil collector for the distribution to the teklab of compressors

Figure 3.6 – Valves and oil circuit ball valves

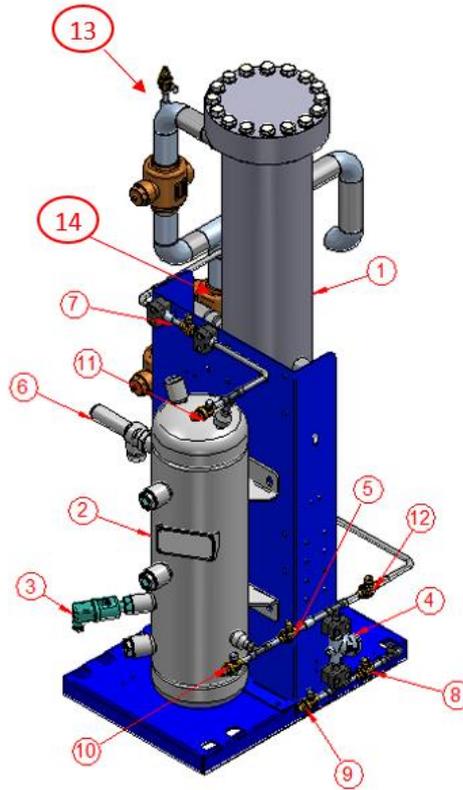
Oil filling procedure during maintenance

The following actions must be undertaken leaving residual pressure in the oil system and charging with an electric pump. Check the position of the ball valves from figure 3.6. Then perform actions as follow:

- Use oil Bitzer BSE 85K.
- Close ball valves 7 and 5 checking 12 is open.
- Connect the oil charge pipe to the service valve 10, open ball valve/service valve 11 to vent the over pressure.
- Charge from point 10, completely filling the oil reserve (about 18LT for EC93, about 10 LT for EC91 in case of a completely empty oil system, in general **DO NOT EXCEED THE THIRD OIL LEVEL INDICATOR OF THE OIL RESERVE**).
- After charging, close 11 and 10. Open 5 and 7.
- Wait and check that the separator optical light starts to fill (the oil will pass from the reserve (2) to the separator (1)).

3. Schematics and P&I for EcoLarge - EcoGiant

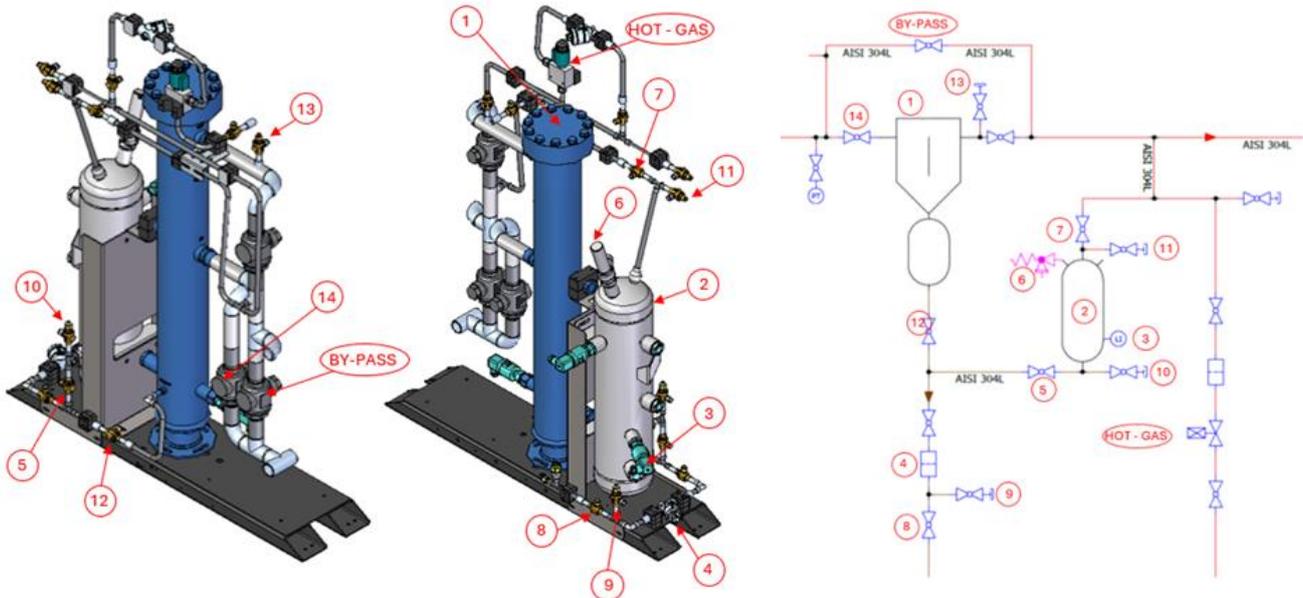
3D oil system for EcoLarge (Module B):



LABEL NUM.	DESCRIPTION	MODULE B	MODULE C
1	OIL SEPARAOT WITH INTEGRATED OIL RESERVE	BOS3-CDH-1BF	BOS3-CDH-1CF
2	SEPARATED OIL RESERVE	10LT PS130	10LT PS130
3	TEKLAB OIL SENSOR		
4	FILTER		
5	BALL VALVE TO EXCLUDE THE RECEIVER		
6	SAFETY VALVE 120bar		
7	BALL VALVE TO EXCLUDE THE RECEIVER		
8	BALL VALVE BETWEEN OIL SYSTEM /TEKLAB		
9	SERVICE VALVE TO VENT		
10	SERVICE VALVE TO CHARGE THE OIL RECEIVER		
11	SERVICE VALVE TO BLOW OUT THE OIL RECEIVER		
12	BALL VALVE TO EXCLUDE THE SEPARATOR		
13	SERVICE VALVE TO BLOW OUT THE WHOLE OIL SYSTEM		
14	BALL VALVE INLET OF SEPARATOR		

4. Schematics and P&I for EcoSmall+

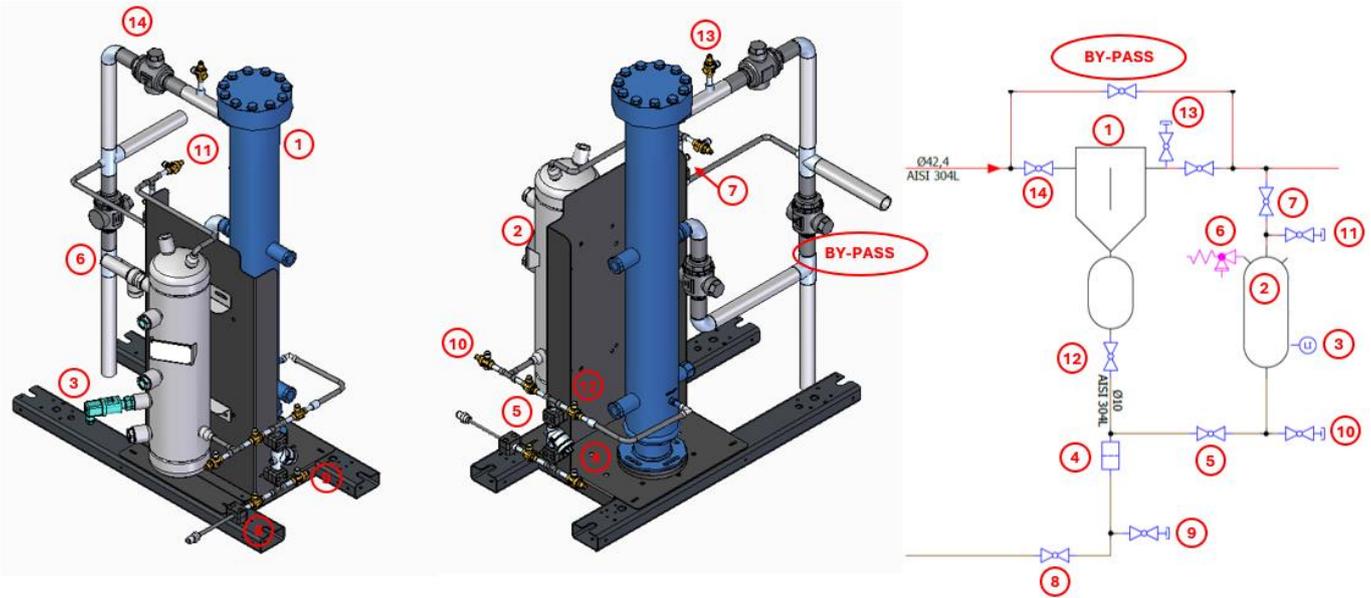
3D oil system for EcoSmall+:



LABEL NUM.	DESCRIPTION	MODULE A
1	OIL SEPARAOT WITH INTEGRATED OIL RESERVE	BOS3-CDH-1AF
2	SEPARATED OIL RESERVE	7LT PS130
3	TEKLAB OIL SENSOR	
4	FILTER	
5	BALL VALVE TO EXCLUDE THE RECEIVER	
6	SAFETY VALVE 120bar	
7	BALL VALVE TO EXCLUDE THE RECEIVER	
8	BALL VALVE BETWEEN OIL SYSTEM /TEKLAB	
9	SERVICE VALVE TO VENT	
10	SERVICE VALVE TO CHARGE THE OIL RECEIVER	
11	SERVICE VALVE TO VENT THE OIL RECEIVER	
12	BALL VALVE TO EXCLUDE THE SEPARATOR	
13	SERVICE VALVE TO VENT THE WHOLE OIL SYSTEM	
14	BALL VALVE INLET OF SEPARATOR	

5. Schematics and P&I for EcoMiddle

3D oil system for EcoMiddle (Module A):



LABEL NUM.	DESCRIPTION	MODULE A	MODULE B
1	OIL SEPARAOT WITH INTEGRATED OIL RESERVE	BOS3-CDH-1AF	BOS3-CDH-1BF
2	SEPARATED OIL RESERVE	7LT PS130	10LT PS130
3	TEKLAB OIL SENSOR		
4	FILTER		
5	BALL VALVE TO EXCLUDE THE RECEIVER		
6	SAFETY VALVE 120bar		
7	BALL VALVE TO EXCLUDE THE RECEIVER		
8	BALL VALVE BETWEEN OIL SYSTEM /TEKLAB		
9	SERVICE VALVE TO VENT		
10	SERVICE VALVE TO CHARGE THE OIL RECEIVER		
11	SERVICE VALVE TO VENT THE OIL RECEIVER		
12	BALL VALVE TO EXCLUDE THE SEPARATOR		
13	SERVICE VALVE TO VENT THE WHOLE OIL SYSTEM		
14	BALL VALVE INLET OF SEPARATOR		